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COMPLETE SPECIFICATION.

Improvements in Valves and Valve Gear for Fluid Pressure Engines, Pumps, and the like.

I, FRANCIS BARRITT VANE, of 18, Richmond Gardens, Shepherds Bush, London, W., Automobile Engineer, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

- 5 This invention relates to valve gears for fluid pressure engines and pumps, in which two or more pistons are arranged parallel to each other and are connected together to drive a common crank shaft, each end of each piston receiving an impulse or acting as a working surface.
- The invention has for its object to provide an improved valve gear for use in connection with fluid pressure engines of the kind described.
- 10 According to the present invention the valve gear comprises a plurality of levers or the like, one for each valve of a set, said valve levers or the like being acted upon by a cam device common thereto, and operated from the connecting-rod of the engine.
- 15 The invention also comprises the particular construction combination and arrangement of parts as hereinafter described.
- In the accompanying drawings:—
- Figure 1, is a plan showing a double acting and reversible internal-combustion engine with the valve gear removed.
- 20 Figure 2, being a side sectional elevation thereof showing the valve gear in position.
- Figure 3, is an under plan view, and Figure 4 is an inverted part sectional side view on a larger scale of the valve gear of the engine shown in Figures 1 and 2, the section being taken along the line A. B. Figure 3, with the members q^1 and q^2 removed, the valve k^2 and its connections included, and the shoe l , shown on O^2 .
- 25 Figures 5 and 6 are two views of an alternative form of valve gear for the exhaust valves of an internal-combustion engine such as shown in the previous figures.
- 30 Referring to the accompanying drawings a pair of double ended cylinders a, b , Figures 1 and 2, are fitted with double ended pistons c, d , connected by a gudgeon pin e , as shown so that both pistons are compelled to move together. A single connecting-rod f , connects the pin e , to a crank g , on a crank shaft h , the two webs of the crank being in the form of discs to form fly-wheels. The driving gear is thus of the simplest form. Each end of each cylinder is fitted with an inlet valve and an exhaust valve. The inlet valves may be of the automatic type as indicated at i^1, i^2 , while the exhaust valves k^1, k^2 , are mechanically operated.
- 35 One form of valve gear adapted for application to the above described engine and which renders same reversible is shown in Figures 3 and 4, adopted for the exhaust valves. A slider or shoe l , is reciprocated by a pin m , mounted on
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the connecting-rod end in any suitable manner so that it can oscillate sideways to permit of the shoe *l*, following a channel of the figure of eight form. The top surface of this channel is made up by the enlarged ends or heads *o*¹, *o*², *o*³, *o*⁴, of pivoted levers *p*¹, *p*², *p*³, *p*⁴, operating the exhaust valves *k*¹, *k*², *k*³, *k*⁴. As the shoe is reciprocated by the connecting-rod end, it follows the channel and pushes up the heads *o*¹ to *o*⁴, in succession and consequently opens the exhaust valves *k*¹ to *k*⁴, in turn. When the engine is run in the reverse direction, the crank shaft is turned in the direction required at starting and then the shoe *l*, follows the channel and pushes up the heads and operates the valves in the desired order. The two heads *o*¹, *o*², where they cross at the centre are nested one in a recess in the other so that they overlap with sufficient clearance between them to avoid simultaneous movement of the two.

The arrangement may be used to effect ignition by fitting four rocker arms *q*¹, *q*², *q*³, *q*⁴, linked together by links *r*, so that they may be rocked simultaneously to bring the arms into the path of the shoe so that as it comes into contact with them it will complete the electric ignition circuit. By suitably moving the rocker arms the time of ignition can be advanced or retarded. The rocker arms may be insulated in any suitable manner. The valve gear is advantageously carried by a suitable frame or the like *s*.

The engine above described imparts two impulses to the crank shaft during each revolution, *i.e.*, one for each stroke of the piston and as the gudgeon pin works through a slot in the side of each cylinder, piston rods with the attendant packing troubles are avoided. The cylinders heads may be water cooled as indicated in Figures 1 and 2.

An alternative form of valve gear is shown in Figures 5 and 6, and while it is applicable to either the inlet or exhaust valves, it is preferably used for the latter. It comprises a single cam 5, adapted to revolve on a central pin 6, and to wipe rollers 7, on the ends of pivoted levers 8, so as to open the exhaust valves *k*¹, *k*², *k*³, *k*⁴, in proper order. The rotation of the cam is effected by a pair of pawls 9, 9, carried by arms 10, 10, pivoted on a rod 11, reciprocated by a rocking lever 12, connected by a link 13, to the connecting rod end. The pawls 9, 9, engage with a ratchet wheel 14, on the pin of the cam, one pawl acting on one stroke of the rod 11, and the other on the next stroke, and so on.

By suitably driving the crank shaft and modifying the valves, the apparatus before described may be used as an air compressor or water or other pump.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is:—

1. In a fluid pressure engine in which two or more pistons are arranged parallel to each other and are connected together to drive a common crank shaft, each end of each piston receiving an impulse, a valve gear, comprising a plurality of levers or the like, one for each valve of a set, said valve levers or the like being acted upon by a cam device common thereto and operated from the connecting rod of the engine, substantially as hereinbefore described.

2. A valve gear as claimed in Claim 1, and wherein the cam device comprises a slider or shoe in connection with the connecting rod, and caused to follow a channel, the top surface of which is made up by the enlarged ends or heads of pivoted levers adapted to operate the valves, substantially as hereinbefore described.

3. In a valve gear as claimed in Claim 2, and for use in connection with an internal combustion engine, the provision of a plurality of rocker arms adapted to be moved into the path of the slider or shoe for ignition purposes, substantially as hereinbefore described.

4. A valve gear as claimed in Claim 1, and wherein the cam device consists of a cam member, the cam face of which contacts with the extremities of a

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plurality of valve operating levers, the cam being operated from the connecting rod through the medium of ratchet mechanism, substantially as hereinbefore described.

- 5 5. The forms of valve gear for an internal combustion engine in which two impulses are imparted to the crank shaft during each revolution, as hereinbefore described or as illustrated by the accompanying drawings.

Dated this 9th day of September, 1912.

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MATHYS & Co.,
Chartered Patent Agents,
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SHEET 1.



